Inclusive growth analysis and HRV: a methodological note

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1. Introduction

The aim of this methodological note is to describe three methodologies potentially useful for inclusive growth analysis: The aggregate growth accounting analysis, the shift-share analysis of labor productivity and the top-down macro-micro models. In each case, our aim is to highlight their pros and cons as well as their data requirement.

The rest of the paper is structured as follows. Section 2 describes the approach for inclusive growth (IG). In section 3 we characterize the three methodologies previously mentioned.

2. The analytics of inclusive growth

As Ianchovichina and Lustrom (2009) stated, inclusive growth country analytics has a distinct character focusing on the pace and pattern of growth. Rapid pace of growth is unquestionably necessary for substantial poverty reduction, but for this growth to be sustainable in the long run, it should be broad-based across sectors, and inclusive of the large part of the country’s labor force. This definition of inclusive growth implies a direct link between the macro and micro determinants of growth and captures the importance of structural transformation for economic diversification and competition, including creative destruction of jobs and firms. Policies for inclusive growth are an important component of any government strategy for sustainable growth and the frameworks for inclusive growth analytics are eclectic in spirit. The main instrument for a sustainable and inclusive growth is assumed to be productive employment. Employment growth generates new jobs and income for the individual - from wages in all types of firms, or from self-employment, usually in micro firms – while productivity growth has the potential to lift the wages of those employed and the returns to the self-employed. The ability of individuals to be productively employed depends on the opportunities to make full use of available resources as the economy evolves over time. The analysis therefore looks at ways to strengthen the productive resources and capacity of the individual on the labor supply side as well as ways to open up new opportunities for productive employment on the labor demand side. The inclusive growth approach takes a long-term perspective, implying that it is important to recognize the time lag between reforms and outcomes. Inclusive growth analytics is about policies that should be implemented in the short run, but for sustainable inclusive growth in the future.

Eduardo Corso is a Senior Economic Research Analyst at the Central Bank of Argentina. This paper was funded through the multi-donor Diagnostic Facility for Shared Growth (DFSG), established to support the development and dissemination of methodological tools and approaches to better determine the binding constraints to shared (inclusive) growth in different country contexts. The findings reflect those of the author, and do not represent the views of the World Bank or any of the countries contributing to the DFSG.
An analysis of inclusive growth must inevitably address the study of the factors behind the growth rate of the economy. In cases where the income level is low, growth is slow and investments are low, the growth diagnostic analysis developed by Hausmann, Rodrick and Velasco (HRV) could become a relevant tool. That’s the reason why the IG approach includes an HRV analysis.

2.1 Growth Diagnostic Analysis

Hausmann, Rodrik, and Velasco (HRV) (2005) develop a heuristic approach to identifying the most binding constraint to growth, i.e., the one with the largest shadow price so as to increase the chance of a positive welfare effect. They use a decision tree framework (See the blue tree structure in Figure 2) based on the “Euler equation” or “Keynes-Ramsey rule” which captures many of the most important factors affecting growth of an economy in the short-run:

\[
\frac{c_t}{c} = \frac{k_t}{c} = \sigma(c_t)(r_t(a_t, \theta_t, x_t)(1 - \tau) - \rho)
\]

Source: Ianchovichina and Lundstrom (2009)

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2 This section is based on Ianchovichina and Lundstrom (2009) and Hausmann, Rodrik and Velasco (2005).

3 This is the Hamiltonian for the simplest Ramsey-type optimal growth model which assumes that households have perfect foresight and need to decide how much labor and capital to rent to firms, and how much to save or consume by maximizing their individual utility subject to their budget constraint. Firms maximize profits at each point in time and produce a single good. In their production function, technology is exogenous, and so are the complementary factors of production and the index of externality. The government spending requirements are assumed to be fixed exogenously, the government imposes a tax on the rental price of capital, so the after-tax return to capital is \( r(1-\tau) \).
which holds in the case of balanced growth equilibrium. In this equation, c is consumption per capita; k is capital per worker, a is technological progress; θ is index of externality; x is availability of complementary factors of productions, such as infrastructure or human capital; τ is the tax rate; \( \rho = z + n \) is the real interest rate; n is population growth; z is the rate of time preference; \( \sigma \) is the inverse of the negative of the elasticity of marginal utility. If the cost of capital \( \rho \) is high for any return on investment, investment is low and the economy is considered liquidity constrained. If the rate of return r is low, for any cost of capital, investment is low and the economy is considered inefficient.4

Figure 2: Including the HRV approach into the IG analytics

Source: Ianchovichina and Lundstrom (2009) and Hausmann, Rodrick and Velasco (2005)

4 The cost of finance \( \rho \) may be high because the country has limited access to external capital markets or because of problems in the domestic financial market. A country may have difficulties accessing external capital markets for a variety of reasons including high country risk, unattractive FDI conditions, vulnerabilities in the debt maturity structure, and excessive regulations of the capital account. Bad local finance may be due to low domestic saving and/or poor domestic financial intermediation. Return to capital r may be low due to insufficient investment in complementary factors of production, such as infrastructure and human capital, low land productivity due to poor natural resource management, or low private returns to capital due to high taxes, poor property rights, corruption, labor-capital conflicts, macro instability, and market failures, such as coordination externalities and learning externalities affecting negatively the country’s ability to adopt new technologies.
The HRV framework is an appropriate framework to study issues of inclusive growth since growth is the main driver of poverty reduction. In cases when growth is concentrated in a few sectors or specific types of economic actors, the HRV framework should be modified and supplemented with analysis of constraints to growth in the slow-growing and emerging sectors, and constraints to individuals to contribute and benefit from growth. The final appropriate framework will depend on country and time specific factors. In cases when growth is high but poverty reduction stagnates, the analysis could be carried out using an inclusive growth analytics framework which is eclectic in spirit. It blends the diagnostic approach with different techniques applied to time-series, firm and household survey data, and cross-country benchmark comparisons to answer questions about trends, constraints to, and sources of sustainable, broad-based growth.

The main instrument for a sustainable and inclusive growth is assumed to be productive employment. Employment growth generates new jobs and income for the individual – from wages or self-employment - while productivity growth has the potential to lift the wages of those employed and the returns to the self-employed. Inclusive growth is not only about employment growth, but also about productivity growth. There is no preconception or bias in favor of labor-intensive industry policies. Indeed, the self-employed need improvements in productivity and leveling of the business environment in order to raise their incomes, and the wage employed need the same indirectly.

The ability of individuals to be productively employed depends on the opportunities to make full use of available resources as the economy evolves over time. The analysis therefore looks at ways to strengthen the productive resources and capacity of the individual on the labor supply side as well as ways to open up new opportunities for productive employment on the labor demand side. If the main problem is lack of employment opportunities for a particular group of individuals due to limited supply of certain types of labor skills, the constraints are related to the productive resources and capacity of individuals rather than the environment in which they can use these resources. This situation calls for an in-depth employability analysis that will shed light on the resources of the individuals, e.g. the individuals’ education, health and the other productivity attributes they bring to a job. If the main problem is low labor productivity or lack of employment opportunities for the individuals due to limited demand for labor, an analysis of the bottlenecks in the business environment is necessary (the HRV approach being one example).

The analysis distinguishes between self- or wage-employed, and further looks at employment by sector, size of firm, rural/urban, formal/informal, and other relevant characteristics. A disaggregate look is necessitated by our main objective to identify the incidence of growth across the income distribution and the bottlenecks to the productive employment of individuals. For example, if the focus is on the poor, in the case of the self employed, we would in most cases focus on a business environment analysis through the lenses of the small and micro enterprises (Figure 1). In the case of the wage employed, we would in most cases focus on an employability analysis as well as a business environment analysis through the lenses of a representative firm, potentially employing the poor (Figure 1).
The business environment analysis follows, but is not limited to, the aggregate-type of growth diagnostics suggested by Hausmann, Rodrik and Velasco (2005). Their organizing framework can be represented as a decision tree as presented in Figure 2. In this analysis the main question is how to raise investments and entrepreneurial activities which are determined by the relationship between private returns to economic activities and cost of finance. Private returns in turn are determined by social returns, which depend on complementary factors or inputs that individuals cannot or has very low incentives to provide - such as geography, technology, infrastructure and human capital, and the private appropriability of these returns. Private appropriability reflects the extent to which social returns are translated into private returns and is negatively affected by government failures and/or market failures. The analysis therefore looks at external factors explaining the country’s growth and poverty reduction pattern, the overall productivity dynamics in the country, the major challenges and opportunities, and possibilities for economic transformation and diversification. The analysis also considers constraints to those sectors with opportunities for productive employment, constraints affecting the ability to gain employment in these sectors, and constraints affecting labor mobility across sectors and regions.

The inclusive growth approach takes a longer term perspective. As mentioned, this is necessary because of the emphasis on improving the productive capacity of individuals and creating conducive environment for employment, rather than on income redistribution as a means of increasing incomes for excluded groups. Due to this longer term perspective, there is an explicit focus on structural transformation and internal migration in the inclusive growth analytics framework. With this longer term perspective, it is important to recognize the time lag between reforms and outcomes. A good example is the lag between the time when investments in education are made and the time when returns from improved labor skills are collected. This implies that the analysis must identify future constraints to growth that may not be binding today, but that may need to be addressed today in order to ensure sustainable and inclusive growth. Inclusive growth analytics is about policies that should be implemented in the short run, but for sustainable inclusive growth in the future.

Summarizing, there are three main steps involved in an inclusive growth analytics.

- The first one involves a background analysis, including an understanding of major factors explaining the country’s past growth and poverty reduction trends and trend-breaks, overall productivity and employment dynamics in the country, major challenges and opportunities faced, and possibilities for economic transformation and diversification.

- The second one consists of putting together the profile of economic actors, while paying attention to particular excluded groups and includes a description of income earning activities of self- or wage-employed, distinguished by sector, size of firm, by geographical area (e.g. rural, urban), by sub-national unit (e.g. provincial, state and others), by type (e.g. formal or informal), and other relevant characteristics. With the findings from these two stages it is possible to get a picture of what activities specific groups are engaged in and to what extent these activities have the potential for growth or if migration to other sectors are possible – in the short and the long run.
- In step three, finding the constraints to inclusive growth, we use the organizational framework presented in Figures 1 and 2 to identify constraints from the perspective of different economic actors. Given its flexibility, the quality of the inclusive growth analysis depends on the quality and variety of tools and data implemented to follow the framework.

3. Useful methodological approaches

As is clear from the previous section, the "inclusive growth" approach is consistent with different methodological approaches. Basically, a study of inclusive growth provides no methodological prerequisite. Instead, the relevant methodological approaches to analyze each node corresponding to figure 1 and 2 depend largely on three elements. First, the structural characteristics of the country under study. Second, the quality and extent of information that is accessible to researchers. Finally, the technical skills of researchers, that ultimately determines the creativity with which the information is used.

In this note we focus on three methodologies that can be useful for the analysis of inclusive growth. Each can be adapted to different nodes of the analysis described in the previous section. The first two methods were chosen because they can be applied to economies in which the availability of statistical information is low. The third methodology is distinguished by the breadth of objectives that can be used. In turn, also has considerable flexibility regarding the requirements of statistical information.

3.1 Aggregate growth accounting analysis

*What it is:* The aggregate growth accounting analysis is a Solow type decomposition of output growth, based on the contributions of labor, physical capital, and productivity growth.

*Why it is useful:* A major advantage of applying the methodology of growth accounting is that data requirements are relatively low. Additionally, this approach can also be used as a starting point for top-down type models.

*Data requirements:* In the case of being used for historical analysis, the approach requires time series of output growth, capital stock and labor force. However, to be used as a tool for analyzing the potential impact on labor demand of different GDP and private investment growth scenarios, the approach does not require of statistical information.

*What it tells us:* The aggregate analysis of growth accounting is particularly useful for analyzing the potential impact on the labor market under different scenarios of GDP growth and private investment. For example, suppose a specific government that establishes a plan
of fiscal policy under particular growth perspectives. What are the requirements in terms of job creation consistent with that scenario? For example, the Syrian case study implements an aggregate growth accounting analysis to argue that attaining annual real growth rates of 7.5 percent over the next 10 years would be a challenge, given that it implies that the economy will need to create an average of 175,000 new jobs per year during this period, or more than twice the number of jobs created annually on average since 2004 (see the contribution to GDP growth of labor in the table that follows).

### Growth accounting decomposition and growth potential

<table>
<thead>
<tr>
<th>Period</th>
<th>GDP Growth</th>
<th>Physical Capital</th>
<th>Labor (adjusted by skills)</th>
<th>TPF, Cobb Douglas (CRS)</th>
<th>Per capita GDP growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960s</td>
<td>4.0%</td>
<td>2.3%</td>
<td>0.8%</td>
<td>0.8%</td>
<td>0.7%</td>
</tr>
<tr>
<td>1970s</td>
<td>9.3%</td>
<td>5.4%</td>
<td>2.5%</td>
<td>1.4%</td>
<td>6.0%</td>
</tr>
<tr>
<td>1980s</td>
<td>2.6%</td>
<td>2.8%</td>
<td>2.0%</td>
<td>-2.2%</td>
<td>-0.9%</td>
</tr>
<tr>
<td>1990s</td>
<td>6.2%</td>
<td>1.0%</td>
<td>2.4%</td>
<td>2.8%</td>
<td>3.4%</td>
</tr>
<tr>
<td>2000-2008</td>
<td>4.4%</td>
<td>2.0%</td>
<td><strong>0.5%</strong></td>
<td>1.8%</td>
<td>2.0%</td>
</tr>
<tr>
<td>2009-2020 (*)</td>
<td>7.5%</td>
<td>4.0%</td>
<td><strong>1.5%</strong></td>
<td>2.0%</td>
<td><strong>5.3%</strong></td>
</tr>
</tbody>
</table>

(*) Forecasted potential.

**Methodological detail:** The accounting presented below as a reference, is a Solow growth decomposition of the change in output per worker, and is based on Hopenhayn and Newmeyer (2004).

Starting from a constant return to scale production function of the form

\[
\frac{Y}{L} = A \left( \frac{K}{L} \right)^{\alpha} h^{1-\alpha}
\]  \hspace{1cm} (1.1)

Where:

\( Y \) = output
\( K \) = capital stock,
\( L \) = number of workers,
\( h \) = average level of human capital
and \( 0 < \alpha < 1 \).

The growth rate of output per worker can be defined as:
\[ \dot{y} = \dot{A} + \alpha \dot{k} + (1 - \alpha)\dot{h} \tag{1.2} \]

where the points above the variables denote the percentage change, and \( y \) and \( k \) are per worker variables. Then, the TFP’s growth rate can be expressed as:

\[ \dot{A} = \dot{y} - \alpha \dot{k} - (1 - \alpha)\dot{h} \tag{1.3} \]

In the growth accounting analysis, the parameterization has a central role. Generally, the alpha’s values are taken from the literature. For example, in the case of Sao Tome and Principe, \((1 - \alpha)\) which stands for the share of capital is assumed to be 0.35.

3.2 Shift-share analysis of labor productivity\(^5\)

**What it is:** Shift-share analysis is a decomposition of labor productivity into overall (economy-wide) labor productivity improvements, movements of labor between sectors, and finally, the interaction effect:

(i) *Within-change or shift component:* It is a weighted average of each sector’s incremental labor productivity, using initial labor shares (a weighted average of TFP, capital stock per worker, and average human capital in the sector, assuming constant returns to scale). This term should explain 100 percent of the variation in per capita output under balanced growth.

(ii) *Between-change or share component:* It is the growth in GDP per worker corresponding to the reallocation of labor across sectors. If labor goes from sectors with low to high labor productivity, the term should be positive.

(iii) *Interaction effect:* It is negative if labor goes from a sector with rising average productivity to sectors with falling output per worker.

**Why it is useful:** In the absence of sector level investment data, analysis of possible labor misallocations can help understand the extent of potential distortions in the allocation of capital. If labor is mobile, distortions in capital allocation should be reflected in the resulting distortions in labor allocation.

**Data requirements:** The information needed for this analysis is a time-series evolution of GDP and employment at the sectoral level.

**What it tells us:** The methodology could be particularly relevant to identify labor misallocation. For example, Artana, Augustine and Panadeirost (2010) present a shift share

\(^5\) This sub-section is based on Hopenhayn and Neumeyer (2004).
analysis for Jamaica. As can be seen in the next table, during the period 1974-1980 the labor productivity fell at 6.04%. The shift component was -4.48%. The share component was negative in 1.41% implying that workers were moving from high labor productivity sectors to low labor productivity sector. The fact that all the shift-share components were negative is a strong evidence of misallocation of labor in this period (highlighted in red in the table).

### Shift-share analysis for Jamaica

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<tbody>
<tr>
<td>Shift</td>
<td>-4.48%</td>
<td>-2.43%</td>
<td>-1.42%</td>
<td>-1.50%</td>
<td>0.95%</td>
<td>-1.66%</td>
</tr>
<tr>
<td>Share</td>
<td>-1.41%</td>
<td>2.10%</td>
<td>2.14%</td>
<td>2.30%</td>
<td>0.02%</td>
<td>0.52%</td>
</tr>
<tr>
<td>Interaction</td>
<td>-0.15%</td>
<td>-0.13%</td>
<td>-0.32%</td>
<td>-0.13%</td>
<td>-0.56%</td>
<td>-0.13%</td>
</tr>
<tr>
<td>Total</td>
<td>-6.04%</td>
<td>-0.46%</td>
<td>0.40%</td>
<td>0.67%</td>
<td>0.41%</td>
<td>-1.27%</td>
</tr>
</tbody>
</table>

Source: Artana, Aguste and Panadeirost (2010)

**Methodological detail:** Output per worker can be written as the sum of output per worker in each sector of the economy times the share of employment, i.e.

\[
y_t = \sum_i l_{it} y_{it}
\]

where the sub-index \( i \) represents each of the goods or groups of goods produced in the economy, \( l_{it} = L_{it} / L_t \) and \( y_{it} = p_{it} Y_{it} / L_{it} \). This formula allows us to link the annual average rate of growth of output per worker between \( t \) and \( t+n \) with the shift-share decomposition:

\[
\frac{1}{n} \ln \frac{y_{t+n}}{y_t} = \frac{1}{n} \ln \sum_i \frac{l_{it} y_{i,t+n}}{\sum_i l_{it} y_{i,t}} + \frac{1}{n} \ln \sum_i \frac{l_{it+n} y_{i,t}}{\sum_i l_{it} y_{i,t}} + \ln \frac{\sum_i l_{i,t+n} y_{i,t+n}}{\sum_i l_{i,t+n} y_{i,t+n}}
\]

(2.1)

The first term on the right hand side measures the within change or shift component, which is a weighted average of the increase in total factor productivity, capital per worker and average human capital in each sector as shown by

\[
\sum_i \frac{l_{i,t} y_{i,t+n}}{\sum_i l_{i,t} y_{i,t}} = \sum_i \frac{p_{i,t} Y_{i,t}}{Y_t} \left( 1 + A_i + \alpha_i \dot{k}_i + (1 - \alpha_i) \dot{h}_i \right)
\]

(2.2)
Where expression (2.2) equals (1.2).

If there is balanced growth the within component should account for 100% of the change in output per worker. The second term in (2.1) corresponds to the between change or share component and it captures how much of the growth in “y” is due to pure reallocations of labor across sectors (output per worker in each sector constant). The third term in (2.1) is an interaction term, which is negative if there is a transfer of labor to sectors with relatively low rates of growth of output per worker. The interaction can be important and negative if labor flows from sectors in which output per worker rises to sectors in which it falls.

3.3 Top-down models

*What they are:* From a general perspective, these models are composed by a dynamic computable general equilibrium model (CGE) and a microeconomic data module, that can either consists of a basic accounting framework, or based on household surveys. The CGE model could be solved recursively for each year of the period under analysis and the shocks to main variables in the model are passed on to the household survey, generating a counterfactual income distribution. The figure that follows shows the three stages that compose a top-down model.

*Why it is useful:* A major advantage of these models is that they can be used to quantify the effect of a wide range of shocks and policy measures —tax reform, accelerated productivity growth, changes in the composition of the investment mix, changes in the skill content of the labor force, etc. — in heterogeneous economies.

*Data requirements:* The information requirement is high, especially with regard to the micro level. For the development of the CGE model, only national accounts statistics are
required. However, the unavailability of household surveys may preclude the performance of simulations, such as the one presented below.

What it tells us: Comparing the various scenarios simulated allows for an assessment of the potential distributional effects of government policy actions as well as potential economic shocks. The Jamaican case study presents an analysis of the potential growth and distributional impacts of recently implemented or soon to be implemented fiscal policies, using a Top-down model. The forward looking analysis is based on linking the 2007 Jamaica household survey with a recursive dynamic computable general equilibrium (CGE) model of the same year. The CGE model is solved recursively for each year between 2007 and 2020, and the shocks to main variables in the model are passed on to the household surveys. We present below two of the scenarios proposed:

Scenario 1: Tax reform.
Scenario 2: Tax reform and additional strengths in fiscal discipline.

The table that follows presents the evolution of the macroeconomic variables simulated using the CGE model.
## National accounts (percent change y-o-y)

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<tbody>
<tr>
<td>GDP at constant prices</td>
<td>-0.95</td>
<td>-2.82</td>
<td>-0.28</td>
<td>2.1</td>
<td>2.1</td>
<td>-0.95</td>
<td>-2.92</td>
<td>-0.22</td>
<td>2.31</td>
<td>2.41</td>
<td>-0.95</td>
<td>-2.92</td>
<td>-0.22</td>
<td>2.31</td>
<td>2.41</td>
<td>2.41</td>
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<tr>
<td>Private consumption</td>
<td>0.1</td>
<td>-9.7</td>
<td>6.2</td>
<td>2.5</td>
<td>2.5</td>
<td>0.1</td>
<td>-10.4</td>
<td>5.6</td>
<td>2.6</td>
<td>2.7</td>
<td>0.1</td>
<td>-10.4</td>
<td>5.6</td>
<td>2.6</td>
<td>2.7</td>
<td>2.7</td>
</tr>
<tr>
<td>Public consumption</td>
<td>-0.9</td>
<td>-2.8</td>
<td>-0.3</td>
<td>2.1</td>
<td>2.1</td>
<td>-0.9</td>
<td>-2.9</td>
<td>-0.2</td>
<td>2.3</td>
<td>2.4</td>
<td>-0.9</td>
<td>-2.9</td>
<td>-0.2</td>
<td>2.3</td>
<td>2.4</td>
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<tr>
<td>Investment</td>
<td>7.9</td>
<td>-31.2</td>
<td>-1.2</td>
<td>1.6</td>
<td>0.5</td>
<td>7.9</td>
<td>-29.6</td>
<td>3.6</td>
<td>2.6</td>
<td>2</td>
<td>7.9</td>
<td>-29.6</td>
<td>3.6</td>
<td>2.6</td>
<td>2</td>
<td>2.1</td>
</tr>
<tr>
<td>Exports</td>
<td>-6.4</td>
<td>-15.8</td>
<td>193</td>
<td>1.8</td>
<td>2</td>
<td>-6.4</td>
<td>-16.2</td>
<td>17.5</td>
<td>1.8</td>
<td>2.1</td>
<td>-6.4</td>
<td>-16.2</td>
<td>17.5</td>
<td>1.8</td>
<td>2.1</td>
<td>2.1</td>
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<tr>
<td>Imports</td>
<td>1.3</td>
<td>-33.5</td>
<td>244</td>
<td>2.2</td>
<td>2</td>
<td>1.3</td>
<td>-33.7</td>
<td>24.6</td>
<td>2.5</td>
<td>2.4</td>
<td>1.3</td>
<td>-33.7</td>
<td>24.6</td>
<td>2.5</td>
<td>2.4</td>
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## Balance of payments (US$ million)

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<tbody>
<tr>
<td>Current account balance</td>
<td>-1,968</td>
<td>-2,349</td>
<td>-1,287</td>
<td>-1,104</td>
<td>-1,475</td>
<td>-1,506</td>
<td>-2,349</td>
<td>-1,287</td>
<td>-1,104</td>
<td>-1,475</td>
<td>-1,506</td>
<td>-2,349</td>
<td>-1,287</td>
<td>-1,104</td>
<td>-1,475</td>
<td>-1,506</td>
</tr>
<tr>
<td>(as percent of GDP)</td>
<td>-14.5</td>
<td>-17.2</td>
<td>-11.1</td>
<td>-8.9</td>
<td>-10.3</td>
<td>-9.5</td>
<td>-17.2</td>
<td>-11.1</td>
<td>-8.9</td>
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<td>-11.1</td>
<td>-8.9</td>
<td>-10.1</td>
<td>-9.2</td>
</tr>
<tr>
<td>(as percent of GDP)</td>
<td>-24.6</td>
<td>-27.7</td>
<td>-22.9</td>
<td>-20.5</td>
<td>-23.2</td>
<td>-23.5</td>
<td>-27.7</td>
<td>-22.8</td>
<td>-21</td>
<td>-24.1</td>
<td>-24.9</td>
<td>-27.7</td>
<td>-22.8</td>
<td>-21</td>
<td>-24.1</td>
<td>-24.9</td>
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<tr>
<td>Exchange rate</td>
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<td>68.56</td>
<td>72.63</td>
<td>71.79</td>
<td>68.97</td>
<td>69.07</td>
<td>68.56</td>
<td>72.33</td>
<td>71.35</td>
<td>68.53</td>
<td>68.55</td>
<td>68.56</td>
<td>72.33</td>
<td>71.35</td>
<td>68.53</td>
<td>68.54</td>
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</table>

## Public finance (percent of GDP)

<table>
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<tr>
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<tr>
<td>Overall balance</td>
<td>-4.1</td>
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<td>-7.7</td>
<td>-7.7</td>
<td>-9.2</td>
<td>-12.3</td>
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<td>-5.9</td>
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<td>-1.4</td>
<td>-0.5</td>
<td>-4.9</td>
<td>-5.9</td>
<td>-2.5</td>
<td>-1</td>
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<tr>
<td>Government revenue</td>
<td>23.3</td>
<td>23.5</td>
<td>22.8</td>
<td>23</td>
<td>23.3</td>
<td>23.3</td>
<td>23.5</td>
<td>24.5</td>
<td>24.9</td>
<td>25</td>
<td>24.9</td>
<td>23.5</td>
<td>24.5</td>
<td>24.9</td>
<td>25</td>
<td>24.9</td>
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<tr>
<td>Total expenditure</td>
<td>27.4</td>
<td>28.4</td>
<td>30.5</td>
<td>30.6</td>
<td>32.5</td>
<td>35.6</td>
<td>28.4</td>
<td>30.4</td>
<td>27.4</td>
<td>26.4</td>
<td>25.4</td>
<td>28.4</td>
<td>30.4</td>
<td>27.4</td>
<td>26</td>
<td>25.1</td>
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<tr>
<td>Recurrent expenditure</td>
<td>24</td>
<td>25</td>
<td>26.7</td>
<td>27.1</td>
<td>29.1</td>
<td>32.2</td>
<td>25</td>
<td>26.6</td>
<td>23.9</td>
<td>23</td>
<td>22</td>
<td>25</td>
<td>26.6</td>
<td>23.9</td>
<td>22.8</td>
<td>21.7</td>
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<tr>
<td>Capital expenditure</td>
<td>3.4</td>
<td>3.4</td>
<td>3.9</td>
<td>3.5</td>
<td>3.4</td>
<td>3.4</td>
<td>3.4</td>
<td>3.8</td>
<td>3.5</td>
<td>3.4</td>
<td>3.4</td>
<td>3.4</td>
<td>3.8</td>
<td>3.5</td>
<td>3.2</td>
<td>3.4</td>
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<tr>
<td>Debt</td>
<td>115</td>
<td>112</td>
<td>130</td>
<td>125</td>
<td>130</td>
<td>153</td>
<td>112</td>
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<td>128</td>
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<td>91</td>
<td>75</td>
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<tr>
<td>Foreign</td>
<td>51</td>
<td>53</td>
<td>65</td>
<td>63</td>
<td>69</td>
<td>81</td>
<td>53</td>
<td>64</td>
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<td>55</td>
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<td>53</td>
<td>64</td>
<td>61</td>
<td>53</td>
<td>48.6</td>
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<tr>
<td>Domestic</td>
<td>64</td>
<td>60</td>
<td>65</td>
<td>61</td>
<td>61</td>
<td>72</td>
<td>60</td>
<td>64</td>
<td>57</td>
<td>39</td>
<td>29</td>
<td>60</td>
<td>64</td>
<td>57</td>
<td>37</td>
<td>26.7</td>
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## Memo (percent change y-o-y)

<table>
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<tr>
<td>Employment</td>
<td>1.672</td>
<td>2.271</td>
<td>1.066</td>
<td>1.02</td>
<td>0.326</td>
<td>1.672</td>
<td>2.189</td>
<td>1.079</td>
<td>1.032</td>
<td>0.343</td>
<td>1.672</td>
<td>2.189</td>
<td>1.079</td>
<td>1.052</td>
<td>0.343</td>
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<tr>
<td>Population</td>
<td>0.426</td>
<td>0.463</td>
<td>0.499</td>
<td>0.368</td>
<td>0.343</td>
<td>0.426</td>
<td>0.463</td>
<td>0.499</td>
<td>0.368</td>
<td>0.343</td>
<td>0.426</td>
<td>0.463</td>
<td>0.499</td>
<td>0.368</td>
<td>0.343</td>
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The microeconomic impact of fiscal policies can be summarized through the next sets of indicators estimated from the micro module.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>2007</th>
<th>No-reform</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
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<tr>
<td>Extreme poverty headcount (%)</td>
<td>2.86</td>
<td>1.54</td>
<td>1.54</td>
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<tr>
<td>Poverty headcount (%)</td>
<td>9.91</td>
<td>6.29</td>
<td>6.09</td>
<td>6.09</td>
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<tr>
<td>Poverty gap (x100)</td>
<td>2.48</td>
<td>1.42</td>
<td>1.39</td>
<td>1.39</td>
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<tr>
<td>Poverty gap squared (x100)</td>
<td>0.95</td>
<td>0.52</td>
<td>0.51</td>
<td>0.51</td>
</tr>
<tr>
<td>Gini</td>
<td>36.78</td>
<td>36.25</td>
<td>35.98</td>
<td>35.97</td>
</tr>
<tr>
<td>Theil (GE1)</td>
<td>23.75</td>
<td>23.03</td>
<td>22.65</td>
<td>22.65</td>
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</table>

The Top-down models: predecessors and potentialities

Measuring the effects of economic policies on poverty and on the distribution of welfare is a difficult task. During the last decade, new methods to evaluate policies have been developed. There are two main groups of methodologies to analyze these effects: The first group corresponds to microeconomic techniques, while the second to the micro-macro approaches, as the top-down model described previously.

Microeconomic techniques

Microeconomic techniques are based mostly on incidence analyses and econometric evaluation approaches in partial equilibrium settings. This group of techniques, namely “accounting incidence analyses” has been applied primarily to analyze issues of incidence of tax and public spending. This approach computes only first-round effects and ignores potential behavioral responses by agents (second round effects). Incidence analysis may take an:

- Ex-ante vs. ex-post analysis: Economic policies can be evaluated before or after they are implemented. Ex ante evaluation involves techniques to predict the effects of policies on distribution and poverty. Identify the direct and indirect effects of a policy are needed to evaluate the policies applied making a comparison between the actual effects with those expected, and then modify those policies that did not produce the expected effects. When we include complex behavioral this distinction is more significant. Ex post approach tries to compare individuals or households before and after some policy change. One might assume that observed differences would reflect the direct effect of the program or the policy reform as well as all possible second round behavioral effects. Ex ante approaches that take into account behavioral responses rely necessarily on some structural modeling of household behavior in the field under scrutiny. These models must be able to predict the likely response of households to a change in the set of alternatives offered to them and they must be consistent with the characteristics and the behavior of the households observed in the sample survey used as a data base.
- Average vs. Marginal effects: A particular policy may involve giving access to particular services (for example, health care) to some part of the population that did not benefit from these services initially. That part of the population usually had not access to these services. Then, it is important to make a distinction between marginal incidence and average incidence to evaluate the actual impact of policy reforms on poverty. This does not mean that the average incidence is irrelevant in such a context. For example, the average incidence analysis is useful when the goal of a policy is to improve uniformly the quality of a particular service.

- Qualitative vs. quantitative approaches: Taking into account that poverty is usually defined in terms of a measurable concept (for example, percentage of population in terms of income), distributional incidence analysis tends to be quantitative. But, social policy has many dimensions that cannot be reduced to an income measure but that are nevertheless important in defining and evaluating the incidence of poverty.

Macro-micro techniques

Macro-micro techniques combine macro and micro modeling frameworks, usually in a general equilibrium context. A macro-micro approach allows assessing the micro effects of macroeconomic policy changes and investigating the second round effects of policy changes. This kind of models provides a better chance to identify specific interventions that can complement growth-oriented development policies. There are two main difficulties that justify the use of a macro-micro modeling framework: (a) it is almost impossible to isolate a control group for a macroeconomic policy because, by definition, all individuals and households are affected by the same policy; (b) it is needed to figure out not only a micro but also a macro counterfactual, and the latter usually has to be done in a general equilibrium setting. Specific questions to be answered and the data quality and availability determine the implementation of an specific macro-micro modeling framework.

The first step in assessing macroeconomic policy effects on poverty and distribution are models with representative households groups. Traditional aggregate macroeconomic models use the simplest and most restrictive assumption that economic policies do not affect the distribution of welfare. These models assume that the economy is composed of only one economic agent or that all individuals in a society are identical. If we assume that the economy is represented by groups of household that share common characteristics (for example, the source of income and consumption preferences), this assumption can be relaxed assuming that economic policies do not affect the distribution of welfare within groups of representative homogeneous households (RHGs). This kind of models has been labeled in the modeling literature as the disaggregated SAM-CGE/RHG model (social accounting matrix–computable general equilibrium). The typical CGE is a macroeconomic model that separates the household population of an economy into RHGs. Desegregation aims to capture the ways through which economic policies would affect the factor allocation and remuneration across RHGs. The SAM-CGE/RHG approach models the functioning of factor markets at the level of aggregation that is compatible with the factor remuneration for each RHG. Under this approach, only the aggregate behavior of these
groups—in terms of supply of labor and consumption demand—matters for the general equilibrium of the economy. Strong assumptions must be made:

- the distribution of relative income within each RHG is policy-neutral, that is, it is not affected by any change in macroeconomic policy;

- the demographic weight of households in each RHG is constant.

Hence, this approach essentially focuses on changes in the distribution between RHGs. Empirically; however, analyses of micro data show that changes of within-RHG inequality can be as important as changes of between-RHG inequality in explaining the evolution of overall inequality. A way to deal with these issues is to introduce as many representative households into the initial CGE/RHG framework as there are in standard household surveys. The household sector in these models includes (a few thousand) heterogeneous individual households reflecting those observed in available household surveys; however, as explained below, a restrictive set of conditions need to be assumed to model the behavior of these household.

Integrating household surveys into macro modeling, whether relying on CGE or other types of models, is undoubtedly the direction to follow to assess the impact of macro policies at the micro level. The mere extension of the CGE/RHG approach to individual households taken from household surveys raises methodological issues that cannot be ignored. The most important difficulty is estimating heterogeneous economic behavior at the household level. Starting from the data of a household survey, the behavior of a specific RHG is generally estimated on the basis of observed differences among “real” households belonging to that same RHG. In other words, variability across household incomes and budget shares is used to estimate the way in which the budget share of the representative household of a group changes with income. This variability requires postulating some functional form, which in turn permits inferring price elasticities derived from income effect. This approach is used when the number of RHGs in the CGE is the same as that for the households in a survey. In this case tighter assumptions are needed. There is no way to “estimate” a consumption model for a household on a single observation except under two alternative stringent assumptions:

1. Observed household budget shares are assumed to be constant—implying a “linear” model with unit income and own-price elasticity of consumption; and

2. Observed household budget shares correspond to a common behavioral model where shares depend on income (and prices) with fixed differences between individual shares and what the model implies.

As with the RHG approach, the common consumption behavior can be estimated through standard econometric techniques applied to the whole sample of household variations, after making some assumption on the functional form to use. Residuals in that procedure stand from some unexplained divergence of individual households from the common model. It turns out that these assumptions are far from being innocuous and may influence both the macroeconomic properties of the whole framework and the simulated microeconomic consequences of a macro policy or shock. Assumption 1 would imply that a proportional increase of income of the whole population of households does not modify the aggregate
propensity to consume, not a very satisfactory property particularly when aggregated at the macro level. Assumption 2 would imply that the simplicity and homogeneity of such a “common behavioral model” for individual behavior regarding important characteristics of individual decisions would yield very limited responses to policy changes at the macro level.

The CGE/RHG approach has inherent limits in terms of modeling the heterogeneity of individuals and households. A solution to avoid the problems mentioned above is to separate the macro and micro parts of the modeling framework. The top-down modeling approach works in a sequential two step fashion:

a. a macro (top) model is solved and,
b. its solution in terms of a vector of aggregate prices, wages, and employment variables, the linking aggregate variables (LAVs)—is used to:
   1. shock a micro-household-level data set: the micro simulation is quite simple and broadly corresponds to the micro accounting incidence analysis (top-down micro accounting models)
   2. target the aggregate solution values of a micro (bottom) model: the microeconometric model includes behavioral responses used to simulate changes in individual wages, self-employment incomes, employment status, etc. These individual changes are simulated in a way that is consistent with the aggregation of the set of LAVs generated by the macro model. When the micro accounting simulation or the micro behavioral simulation is completed, a full counterfactual distribution of household income is produced and the (macro) policy change can be evaluated (top-down micro simulation models).

Top-down micro accounting models

In these micro accounting models, micro data sets are linked to disaggregated macro models by directly applying changes in prices and wages that result from the solution values of the macroeconomic model. For example, sector-specific vectors of macro simulated prices and wages are used to construct a counterfactual income for each individual or household, using simple multiplication or replacement techniques: the actual price and wage rate that explain the components of income for each individual are replaced by the simulated values.

The assumption of no behavior responses has been a major criticism of these micro accounting models, but under certain not overly restrictive conditions, it can be demonstrated that these models are fully consistent with microeconomic behavior. In fact, they estimate first-round effects, which are a good approximation of total welfare when changes in prices and wages are small and markets are competitive. Behavior responses can be ignored when the macro policy shock causes only marginal changes in the budget constraints faced by agents and when no agents are rationed or do not operate in a perfect market. Combining the utility theory of consumer behavior and relying on the envelope theorem (or Sheppard’s lemma or Roy’s theorem), provide a formal demonstration that micro accounting is consistent with behavior.
Apart from cases in which changes are not marginal and markets are not perfectly competitive and the behavioral responses cannot be ignored, an important drawback of this approach is given by the unidirectional link between the macro and micro parts of the modeling framework. This means that distributional changes at the micro level do not provide any feedback to the aggregate variables at the macro level: these are determined exclusively by the macro model.

Top-down micro simulation models

The second way to conduct top-down macro-micro modeling is to link the macro model to a micro simulation module. The key difference between the simpler accounting approach and micro simulation is that this approach can be used when the envelope theorem is not applicable—for example, when the policy simulated modifies the labor participation decision and/or when there are market imperfections such as rationing. In these circumstances, considering behavioral responses at the micro level becomes essential. These responses are normally simulated by using a structural or reduced-form econometric model, which is initially estimated (or calibrated) from the cross-section data of the household survey. As mentioned, this type of micro model can handle market imperfections. In other words, these macro-micro models reconcile the disequilibrium captured by the macro model variables—where prices, wages, and employment will incorporate the effect of market imperfections—and the heterogeneity of individual behavior. Some individuals are more likely to be responsible for the changes observed at the macro sectoral level.

Econometric models of occupational choice by household members allow this allocation to be performed, accounting for individual heterogeneity while using the relevant variables from the macroeconomic general equilibrium model to build the counterfactual distribution. These econometric models essentially consist of multilogit models of occupational choices that are conditional on individual and household characteristics. The micro simulation includes modifying a subset of parameters of the multilogit model to generate aggregate levels of employment by occupational type, skill, gender, and so on, which exactly match the results coming from the CGE macroeconomic model. Practically, the procedure uses the intercepts in multilogit models to match micro simulated employment and the results of the macro model. The intercept is adjusted for each individual in a given group so that the average of the group matches (actually, it converges through all the resulting changes in occupational choices in the group) the average of the same group in the macroeconomic model. The procedure remains, however, top down in the sense that there is no feedback between the micro and the macro levels, that is, no explicit link or interaction exists between the micro level results and the actual prices in the macro model.

Taking into account individual heterogeneity in modeling occupational choices this procedure certainly adds accuracy and nuance.

The counterfactual distributions obtained under the assumption that distribution of income within RHG (defined by the occupation of household head) is constant provide different results than the distributions obtained with the top-down micro simulation framework. The
latter is closer to actual distributions and thus allows a better grasp of the impact of macroeconomic policies on specific groups and segments of the distribution: it appears that it constitutes a more accurate and better tool. In particular, the counterfactuals are radically different in an important dimension, namely, the percentiles of the distribution most affected by the experiment. This is a crucial piece of information to design well targeted compensatory or supportive responses to a given macroeconomic reform.

Toward an Integrated Macro-Micro Model: Feedback Loops from Bottom to Top

Under both the micro accounting and micro simulation top-down models, the results from the LAVs are “injected” into the micro data set that either takes them as givens or adjusts to them. After the changes are computed, however, the aggregated result of, say, the sum of consumption for all households in the micro data set can be different from the result of the aggregate private consumption calculated by the macro model. In other words, there is no feedback from the micro to the macro parts of the modeling framework.

Bourguignon and Savard (see François Bourguignon, Maurizio Bussolo and Luiz A. Pereira da Silva (eds) (2008), Chapter 6) propose a different and simpler approach that is applicable to imperfectly competitive environments. This iterative approach has several advantages over a method that would solve simultaneously for all individual and aggregate equilibrium conditions, as in the CGE/RHG model category with fully disaggregated household groups:

- First, the macro and the micro parts of the model do not have to be fully consistent in terms of consumption or income aggregates. In many cases, the underestimated aggregate consumption from a household survey does not need to be adjusted to the national accounts generally used in CGE modeling.

- A second advantage is that no limit needs to be imposed on the level of disaggregation in terms of production sectors and number of households to be included in the model.

- A third advantage is that, with respect to other approaches, fewer restrictions apply to the choice of functional forms for the consumption and labor supply behavior of households. In particular, there is no need to choose functional forms with good aggregation properties.

The Fully Integrated Micro-Based CGE Approach

Quite naturally, one wonders whether or not the convergence process described above truly puts microeconomic consistency into the behavior of the macro aggregates. If the ultimate objective is to get a fully consistent macro-micro framework or, in other words, if the goal is to build the poverty impact of macro policies from the strongest basis of micro observations, then a fully integrated microbased CGE should be the preferred method.
Why not aim to build macroeconomic behavior from all individuals and households in a sample survey? Seems logical to circumvent the problems of standard CGE/RHG models using a modeling strategy focusing on each household, but some problems remain. One is the difficulty of calibrating structural behavioral models for individual households with the type of micro data set that is available. The rudimentary way through which some key structural behavior—such as consumption and investment—is modeled at the household level poses a problem for the properties of the overall model when the whole sample (thousands) of households is aggregated.

Would the aggregate behavior of all individuals and households for private consumption or investment “react” to macroeconomic policies with the same “known macroeconomic textbook properties” as the observed aggregate variables in national accounts? For example, the macroeconomic literature suggests that aggregate private consumption is sensitive to income, inflation, and interest rates; however, if it is not possible—because of the lack of data at the individual level—to estimate one or all of these elasticities, what would be the overall properties of the macroeconomic model constructed with the aggregation of these insufficiently modeled household behaviors? In addition, econometric problems result from the difference between estimations done in cross-section with the last available household survey and those done with time-series for larger groups, or with panels. The other question—when the modeling of key structural behavioral is limited—is where does the heterogeneity come from? One interpretation is that heterogeneity can be a standard residual in the regression equation across households, which is written to explain the behavior at hand, for example, private consumption. Another interpretation is to accept heterogeneity as a “heterogeneous behavioral coefficient” that can be added to the coefficients used to explain private consumption. But then the identification problem remains for this coefficient, because, as an example and thinking of the consumption function of a given household, the two interpretations of heterogeneity given above are observationally equivalent—up to heteroskedasticity. Yet they have different implications in terms of aggregate behavior.

References


Appendix: Highlights of the methodologies

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<thead>
<tr>
<th>Aggregate growth accounting analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Most relevant application:</strong> The aggregate analysis of growth accounting is particularly useful for analyzing the potential impact on the labor market under different scenarios of GDP growth and private investment.</td>
</tr>
<tr>
<td><strong>Data:</strong> output growth, capital stock and labor force</td>
</tr>
<tr>
<td><strong>Specific skills:</strong> Basics of theory of economic growth.</td>
</tr>
<tr>
<td><strong>Software:</strong> Spreadsheet (Excel, Lotus, etc).</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Shift-share analysis of labor productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Most relevant application:</strong> Labor misallocation analysis.</td>
</tr>
<tr>
<td><strong>Data:</strong> GDP times series and employment at the sectoral level.</td>
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<tr>
<td><strong>Specific skills:</strong> Basics of theory of economic growth.</td>
</tr>
<tr>
<td><strong>Software:</strong> Spreadsheet (Excel, Lotus, etc).</td>
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</tbody>
</table>
Top-down models

**Most relevant application:** To quantify counterfactual scenarios in order to evaluate specific measures of policy and economic shocks.

**Data:** Macroeconomic data is needed to estimate or calibrate the computable general equilibrium (GEM) in the “top” of the model. Household surveys are needed for the “down” side of the model.

**Specific skills:** Experienced qualitative teams on micro-econometric and simulation procedures.

**Software:** Stata, MATLAB.